EXHIBIT C

Reply Comments of EchoStar Satellite L.L.C.,

filed in ET Docket No. 05-182 (June 17, 2005)

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Technical Standards for Determining	)	
Eligibility For Satellite-Delivered Network	)	ET Docket No. 05-182
Pursuant To the Satellite Home Viewer	)	
Extension and Reauthorization Act	)	
Reauthorization Act of 2004	)	

REPLY COMMENTS OF ECHOSTAR SATELLITE L.L.C.

David K. Moskowitz
Executive Vice President and General Counsel
ECHOSTAR SATELLITE L.L.C.
9601 South Meridian Boulevard
Englewood, CO 80112
(303) 723-1000

Karen Watson
Ross Lieberman
ECHOSTAR SATELLITE L.L.C.
1233 20th Street, N.W.
Washington, D.C. 20036-2396

Pantelis Michalopoulos
Rhonda M. Bolton
Chung Hsiang Mah
STEPTOE & JOHNSON LLP
1330 Connecticut Avenue, NW
Washington, D.C. 20036
(202) 429-3000

Counsel for EchoStar Satellite L.L.C.

July 5, 2005

TABLE OF CONTENTS

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Technical Standards for Determining	)	
Eligibility For Satellite-Delivered Network	)	ET Docket No. 05-182
Pursuant To the Satellite Home Viewer	)	
Extension and Reauthorization Act	)	
Reauthorization Act of 2004	)	

REPLY COMMENTS OF ECHOSTAR SATELLITE L.L.C.

EchoStar Satellite L.L.C. ("EchoStar) hereby submits its reply comments on the Notice of Inquiry released by the Commission on May 3, 2005 ("NOI). The NOI sought comment on the adequacy of the digital signal strength standard and testing procedures used to determine whether households are eligible to receive distant digital television ("DTV) network signals from satellite carriers.[1]

EchoStar urges the Commission to reject the often counter-intuitive submissions of broadcaster interests that would reduce the accuracy of digital signal strength testing and/or future predictive models in determining whether a consumer can actually receive a good quality digital picture over-the-air at his or her location using readily available consumer equipment. Such rules would doom millions of subscribers to inadequate DTV reception and delay the DTV transition that Congress has done so much to foster. If the DTV transition nonetheless proceeds,

---

[1] *Technical Standards for Determining Eligibility For Satellite-Delivered Network Signals Pursuant to the Satellite Home Viewer Extension and Reauthorization Act*, FCC 05-94, Notice of Inquiry, ET Docket No. 05-182 (rel. May 3, 2005), published 70 Fed. Reg. 28503 (2005) ("NOI).

such proposals could mean that millions are left behind, without *any* high definition signal from one or more networks.

In addition, because the scope of the distant digital signal license is not the subject of this inquiry, the Commission should resist making premature pronouncements about the meaning of the statutory copyright license provisions, despite broadcasters' extensive submissions on this topic, and should focus instead on its statutory mandate to consider improvements to the digital signal strength standard and testing procedures. Finally, the Commission should dismiss, for being completely irrelevant to this proceeding, the gratuitous attacks made by broadcasters against the integrity of the Direct Broadcast Satellite ("DBS) industry.

I. THE COMMISSION SHOULD AVOID MAKING INTERPRETATIONS ABOUT THE SCOPE OF THE DISTANT DIGITAL LICENSE THAT ARE IRRELEVANT TO THIS PROCEEDING

As an initial matter, EchoStar notes that the National Association of Broadcasters ("NAB) and the ABC, CBS, and NBC Television Affiliate Associations ("Network Affiliates) devote many pages in their comments to setting out their interpretation of the general scope of the statutory license for distant digital signals, pointing to new limitations on the carriage of such signals introduced by the Satellite Home Viewer Extension and Reauthorization Act of 2004 ("SHVERA).[2] No doubt, the broadcasters would like the Commission to endorse its view of those provisions.

This inquiry, however, is not about the general scope of the distant digital signal license. Instead, this is "an inquiry regarding whether, for purposes of identifying if a household

[2] Comments of National Association of Broadcasters at 1-13, *filed in* MB Docket No. 05-182 (filed Jun. 17, 2005) ("NAB Comments); Comments of the ABC, CBS, and NBC Television Affiliate Associations at 1-13, *filed in* MB Docket No. 05-182 (filed Jun. 17, 2005) ("Network Affiliates' Comments).

is unserved by an adequate digital signal under [17 U.S.C. § 119(d)(10)], the digital signal strength standard in [47 C.F.R. § 73.622(e)(1)], or the testing procedures in [47 C.F.R. § 73.686(d)], such statutes or regulations should be revised to take into account various statutory factors affecting signal strength and reception.[3] To this end, the Commission is required to deliver a report to Congress with its recommendations for changes to the digital signal strength standard or testing procedures, including a recommendation on whether to use a predictive model to determine whether a household is "unserved. [4] This inquiry has nothing else to do with the digital signal license.

Accordingly, the broadcasters' extensive submissions in this regard are irrelevant and the Commission should resist making premature pronouncements about the meaning of the statutory license provisions beyond the scope of the inquiry mandated by Congress. Otherwise, the Commission risks making interpretive rulings in the abstract that parties may later claim were definitive and worthy of deference. Even more important, the Commission is not charged with enforcing the copyright laws. The courts, and not the Commission, are tasked with adjudicating disputes over the scope of 17 U.S.C. § 119.

II. THE COMMISSION SHOULD RECOMMEND CHANGES TO THE DIGITAL SIGNAL STRENGTH STANDARD, TESTING PROCEDURES AND FUTURE PREDICTIVE MODELS THAT WOULD IMPROVE, NOT WORSEN, THEIR ACCURACY IN DETERMINING WHETHER A HOUSEHOLD IS "UNSERVED"

Whether a household is unserved by a digital over-the-air signal should be measured against the consumer's ability to receive a good quality picture in the location in which he or she resides using readily available consumer equipment. The adequacy and accuracy of the

---

[3] *See* 47 U.S.C. §§ 339(c)(1)(A) and (B).

[4] *See* 47 U.S.C. §§ 339(c)(1)(B)(iv) and 339(c)(1)(C).

digital signal standards, the testing procedures, and future predictive models should be judged against this standard.

As EchoStar has pointed out, digital television ("DTV) reception problems can result not only in degraded picture quality but, more often than with analog reception, can also result in the consumer not being able to receive a picture at all.[5] Consequently, it is important to ensure that the digital signal strength standard, the testing procedures, and any predictive model used to determine whether a household is unserved, take into account all factors that affect whether an artifact-free DTV *picture* can actually be received, and not merely whether the DTV *signal* is strong enough at the location in question. Contrary to the broadcasters' suggestion, the fact that Congress chose to limit the availability of distant digital signals in SHVERA does not reduce the need for accuracy in the remaining situations in which it is important to determine when a household is unserved. Indeed, these are the households most at risk during the digital transition -- *i.e.* households in smaller, typically rural, markets that cannot get a local digital signal over-the-air and in which cable service and/or satellite local-into-local service may not be available.

In its comments, EchoStar's engineering experts, Hammett & Edison, Inc. (H&E), have shown why some of the assumptions in the Commission's DTV planning factors appear to have been unrealistic. In a supplemental report (Attachment A), H&E further responds to the accuracy of the assumptions in the DTV planning factors raised by broadcasters ("H&E Reply Statement). In addition, EchoStar has proposed several changes to the digital strength standard, testing procedures and predictive methodology that would make them more accurate in determining when a household is digitally "unserved, including the use of indoor antennas, the

[5] Comments of EchoStar Satellite L.L.C. at 2, *filed in* MB Docket No. 05-182 (filed Jun. 17, 2005) ("EchoStar Comments).

lack of rotation in many consumer antennas, and the need to take into account time variability in signal strength. In contrast, many of the broadcasters' comments and suggestions would have the opposite effect or impose unreasonable burdens on consumers.

The Broadcasters Ask Consumers to Make Unreasonable Expenditures to Gain Access to an High-Definition Signal. What is squarely *within* the scope of this inquiry is the extraordinary burden that the consumer would have to bear in order to satisfy all the requirements suggested by the broadcasting industry in order to receive a clear over-the-air digital signal. The broadcasters would have consumers purchase an incredible litany of state-of-the-art equipment, each straining further the consumer's budget: the most up-to-date "generation of DTV receiver in order to reduce (without eliminating) multipath interference problems; a low-noise amplifier ("LNA) to boost DTV reception; Type RG-6 coaxial cable to avoid downlead line loss; separate antennas for VHF and UHF to improve reception; and some external means of switching between the two antennas. The cumulative cost of these items to consumers will be significantly above the cost of an analog-to-digital converter box that the broadcasters are urging Congress to provide as a subsidy for analog viewers. Finally, this enumeration of costs for additional items does not include any fees associated with installing these devices in consumers' homes.

The Commission's Planning Factors Were Intended Primarily For Channel Allotments. It is important to note that the DTV planning factors were developed primarily for a purpose different from that here. As H&E explains, these factors were adopted in part to assign channel allotments, and not for the more granular purpose of concretely ascertaining whether a particular consumer could actually receive a DTV picture at his or her home. Even more important, many of these factors have been overtaken by events.

For example, as H&E points out, the planning factors assume different receiving antenna patterns for analog and DTV reception.[6] The belief underlying that assumption was that consumers would install better-performing antennas for DTV use. In fact, however, events on the ground suggest a more reasonable assumption is that they will not. H&E notes that the specified 28 dBu minimum field strength required for DTV reception at VHF low-band has also been criticized as being inadequate,[7] largely due to inadequate consideration of man-made noise at those channels. Additionally, the planning factors assume that interference from DTV stations operating on other than co- and adjacent-channels would not exist. This assumption was in turn based upon the performance of a dual-conversion prototype DTV receiver. Again, subsequent developments have cast doubt on that assumption. Most of all, consumer DTV receivers today are single-conversion, meaning that they are far more susceptible to interference from so-called "taboo channels. [8]

Now that several generations of consumer DTV receivers are available, it is appropriate for the Commission to draw upon actual experience with this equipment to employ more empirically tested planning factors in this proceeding, since such factors will more accurately reflect the consumer's ability to actually receive a DTV picture.[9]

---

[6] See H&E Reply Statement at 5 (citing H&E Petition for Reconsideration in MM Docket No. 87-268, filed June 13, 1997).

[7] *See id.* at 6 (citing Victor Tawil and Charles Einolf, Jr., "Impact of Impulse Noise on DTV Reception at Low VHF, Proc. IEEE Broadcast Technology Symposium, 2004).

[8] *Id.*

[9] In its Comments, EchoStar highlighted the results of an H&E study revealing that the signal sensitivities of the current generation of DTV receivers can be significantly worse than the signal sensitivities assumed in the Commission's planning factors. *See* EchoStar Comments at 4. H&E concluded that the digital strength standard should be revised upward to take into account the reality of DTV receiver sensitivity.

Use of Outdoor Antennas for Testing Would Lead to Many Inaccurate Determinations of When a Household is "Unserved." The NAB essentially concedes that "[i]ndoor antennas perform much less well at receiving over-the-air TV signals [10] because they have lower gain, are typically located at lower heights than outdoor antennas, are nondirectional, and are prone to dynamic multipath problems that affect reception.[11] Counter-intuitively, however, the NAB's proposed solution is to continue digital signal strength testing using properly pointed roof-top antennas.[12] This would virtually guarantee an inaccurate determination of whether a household is unserved for the many (*e.g.* apartment dwellers) that cannot practically install directional rooftop antennas.

The fact that the Commission's DTV planning factors assume the use of rooftop antennas, raised by NAB as a justification for its position, is beside the point. The pertinent question here is not broadcasters' service area requirements. It is a simple and concrete inquiry: whether the consumer in question can actually receive a good quality digital picture over-the-air. Accordingly, the Commission should utilize actual, empirically-based planning factors in this proceeding, including use of indoor antennas. Equally unavailing is NAB's assertion that the viewers in question will also be utilizing a satellite dish, which is typically installed outdoors.[13] The fact that such residents will also need a properly pointed satellite dish does not justify use of outdoor antennas for testing. DBS antennas are typically smaller and need only be pointed in one direction, whereas outdoor DTV antennas typically require substantially more space and

---

[10] NAB Comments at 16-17.

[11] *Id.* at 17.

[12] *Id.* at 16; *see also* Network Affiliates Comments at 34.

[13] *See* NAB Comments at 18.

may need to be rotated to adequately capture different over-the-air stations. As a result, a DBS antenna is practicable in many settings where a rooftop DTV antenna is not.

The Use of Directional Gain Antennas for Testing Has Already Been Correctly Rejected by the Commission. The Network Affiliates suggest that tests be conducted using a directional gain antenna as opposed to a half-wave dipole antenna.[14] This, they say, would "ameliorate any difficulties that could be caused by multipath at the site. [15] This suggestion is misguided, would likely lead to inaccurate results in determining whether a household is "unserved, and has for these reasons already been rejected by the Commission in the analog context. Directional gain antennas are not representative of most indoor antennas.

Moreover, directional gain antennas are more difficult to calibrate and are more easily damaged (leading to an uncalibrated condition). They are also more expensive. These shortcomings have already led the Commission to reject use of directional gain antennas for signal measurement under the Satellite Home Viewer Act:

> Regarding the preparation for measurements, we considered the kind of testing antenna that should be used and conclude that a tuned half-wave dipole is the best choice. It is widely available, inexpensive, and simple to use. In situations where definite readings are required, it has advantages over gain antennas that are difficult to characterize (calibrate) over a wide range of frequencies. Although dipole antennas are susceptible to interference from signals other than the one being measured, the cluster measurements that we require will mitigate those effects.[16]

---

[14] Network Affiliates Comments at 38.

[15] *Id.*

[16] *See Satellite Delivery of Network Signals to Unserved Households for Purposes of the Satellite Home Viewer Act; Part 73 Definition and Measurement of Signals of Grade B Intensity*, 14 FCC Rcd 2654, at ¶ 51 (1999) (citations omitted).

"Fifth-Generation" And Later Receivers Are Not a Panacea for Dealing With Multipath Interference. The Network Affiliates' candid admission that there may be multipath problems sits uneasily with their position that "multipath should not be taken into account in determining whether a household is served by an adequate digital signal. [17] To arrive at this cavalier disregard of the problem, the Network Affiliates note that "fifth generation or the "latest receivers can deal with more types of multipath. The Commission should resist adopting that position. While the latest receiver designs do appear to have improved abilities to receive digital signals in the presence of certain types of multipath over prior generations, they do not represent a panacea. As H&E explains, the white noise enhancement penalty associated with the operation of the equalizer in the DTV receiver still remains and must be considered.[18] The presence of multipath at a receiving site effectively reduces the available strength of the DTV signal at that site because the equalizer in the receiver generates noise in proportion to the degree of multipath.[19] For example, if there is 3 dB of white noise enhancement, then a receiver that had a 15.2 dB noise threshold under ideal conditions (*i.e.*, no multipath) will have a 18.2 dB noise threshold under the multipath condition. This 3 dB increase in noise is equivalent to a halving of the transmitter power of the DTV station. The NAB presents data[20] showing that fifth generation receiver performance under some static multipath conditions requires 3–4 dB of additional signal to overcome the white noise penalty. Since white noise enhancement can be substantial at sites having severe multipath, it is important that this parameter be measured and subtracted from the nominal measured field strength in any field test.

---

[17] Network Affiliates Comments at 37.

[18] H&E Reply Statement at 4.

[19] *Id.*

[20] NAB Comments at 41, Table 12.

Equally importantly, H&E explains that fifth generation designs generally have failed to address difficulties associated with producing a usable DTV picture under dynamic (as opposed to static) multipath conditions, which may account for the continuing failure to receive about 10% of signals under empirical conditions.[21] And H&E notes that improvements in the performance of the fifth-generation demodulators do nothing to improve the performance of other components in the DTV receiver. Specifically, the performance of the tuners in consumer DTV receivers has been criticized as limiting DTV reception in the presence of otherwise adequate signal levels.[22] While these DTV tuner problems are largely associated with the presence of strong interfering signals, there may be impacts at many locations on consumer reception of network signals, which will not be resolved by use of fifth generation receivers.

Finally, the Commission should keep in mind that consumers generally have no knowledge of what "generation DTV receiver they are purchasing. The "generational concept is one employed by consumer electronics manufacturers, and is not something publicized to consumers at large. Indeed, even engineering experts at times have difficulty ascertaining what "generation a receiver might be, and manufacturers are not necessarily willing to supply such information.[23] Thus, consumers may be expected to seek the product having the lowest cost. They may often do so even if provided with detailed information concerning the performance characteristics of that product. For all of these reasons, the Commission should not rely upon the roll-out of fifth generation and later receivers as a substitute for coming to grips with known difficulties such as multipath.

---

[21] H&E Reply Statement at 5 (citing Tim Laud, *et al.*, "Performance of 5th Generation 8-VSB Receivers, IEEE Trans. Consumer Electronics, Vol. 50, No. 4, November 2004).

[22] *Id.* (citing Charles W. Rhodes, "Interference Between Television Signals Due to Intermodulation in Receiver Front-ends, Proc. IEEE Broadcast Technology Symposium, 2004).

[23] *See id.*

The Commission Should Take Into Account the DTV Signal's Time Variability. As EchoStar explained in its Comments in this proceeding, the Commission should bear in mind that field measurements are no more than a "snapshot of typical reception conditions and thus, are inadequate to ensure long-term reliability of DTV reception.[24] While DTV service is to have at least 90% reliability over time, a single a single set of cluster measurements cannot adequately characterize the time variability to provide reasonable assurance that the DTV signal will be available 90% of the time. Therefore, some additional action, such as applying a correction factor, must be done. This issue appears to have garnered little, if any, comment from other participants in this proceeding.

Given that the FCC's criterion for DTV coverage is a specified threshold field strength with 50% confidence, 90% of the time, that is, a situational variability factor of 50% and a time variability factor of 90%, commonly written as F(50,90), a 90% time (or greater) reliability factor should be applied to the assumed median value obtained during the cluster measurements to adjust the assumed "typical measured field strength to a 90% time value.[25]

The Commission Should Not Assume That All Consumers Have Low-Noise Amplifiers. The broadcasters also suggest that it is reasonable to assume that consumers use low-noise amplifiers ("LNAs) mounted near their rooftop antennas to boost DTV reception.[26] This is a wholly unrealistic assumption for a number of reasons. First, most LNAs, however, are not suitable for use with indoor antennas.[27] Moreover, encouraging broader use of LNAs can

---

[24] *See* EchoStar Comments at 8-9.

[25] *See* H&E Reply Statement at 6.

[26] NAB Comments at 22-23; Network Affiliates' Comments at 23-27.

[27] Low-noise amplifiers installed indoors are often ineffective because of the high radio frequency noise levels encountered in such environments. *See* http://www.tvantenna.com/support/tutorials/uhf.html (Presented by The National Association of

create serious unintended consequences. LNAs can make receiving installations prone to "overload problems. That is, a strong nearby station (such as an FM broadcast station or amateur radio station) can overload the LNA, such that it does not function for reception of DTV signals. There is also a history of aging-related problems associated with LNAs, such that broader use should not be encouraged. Because they are installed outdoors and subject to many hot/cold cycles over time, many LNAs become unstable and self-oscillate -- basically becoming transmitters -- causing interference to various services, including public safety.[28] The FCC thus could create a significant new enforcement burden for itself by encouraging widespread consumer use of LNAs. Accordingly, tests should not be conducted using LNAs, nor should future predictive models for DTV reception assume that such amplifiers have been installed.

Land Cover and Land Clutter Values Should be Included in Predictive Models. As EchoStar has consistently pointed out, the ILLR does not, in fact, incorporate realistic values for land use and land clutter. This fact is borne out by a comparison between measured and predicted (using Longley-Rice) signal strengths conducted and reported by Anita Longley, *et al.* of the Institute for Telecommunications Sciences. As H&E explains, Ms. Longley reports that there are many cases when the results of the predictive model do not agree with the field measurements: "Some of the differences between predicted and measured median values may be caused by terrain clutter, such as buildings and trees, which has not yet been included in the

---

Broadcasters, PBS, and Stallions Satellite and Antenna) ("This [preamplifier] unit should be mounted on the antenna mast about a foot below the main boom of the antenna...) *and* Network Affiliates Comments at Exhibit 1 (Antennacraft Pre-amplifiers are designed to be "mast-mounted; Blonder-Tongue preamplifiers are designed to "mount on a 1.5 inch O.D. (max) antenna mast....).

[28] *See* Robert D. Weller, "Radio Frequency Interference from Non-Licensed Devices, RF Design, August 1992 (noting that about 6,800 reports of interference from non-licensed devices were found in the FCC's Case Management System database over the period October 1989-February 1992. A number of these reports were ultimately traced to radiating television pre-amplifiers).

prediction models. [29] Ms. Longley later added: "The [Longley-Rice] propagation model calculates transmission loss, with allowances for radio frequency, terrain irregularity, path length, and antenna elevation. Most of the data previously considered [in developing the model] were from open areas, towns and small cities. To this model, we can now add an allowance for the additional attenuation due to urban clutter.... [30] She then described a method for incorporating the effects of clutter, but this method is not incorporated into version 1.2.2 of the ITS Irregular Terrain Model, which underpins ILLR.

H&E observes that while it is possible that some of the data sets used in the development of the Longley-Rice model unavoidably contained clutter, clearly most did not, and the type or degree of such clutter, when present, was not systematically collected or included in the model. Even the Hufford paper cited by the Network Affiliates acknowledges this: "It should then be noted that these data [for the model] were obtained from measurements made with fairly clear foregrounds ... [i]n general, ground cover was sparse . . . , [31] which suggests careful site selection to minimize interference from clutter.[32] Indeed, Hufford advises users to "make suitable extra allowances or additions when employing the model in "urban conditions or other heavy land-cover situations.[33]

---

[29] H&E Reply Statement at 1-2 (quoting A. G. Longley, "Measured and Predicted Long-Term Distributions of Tropospheric Transmission Loss, OT/TRER Report No. 16, July 1971, at 5) (internal quotation marks omitted).

[30] H&E Reply Statement at 2 (quoting A. G. Longley, "Radio Propagation in Urban Areas, OT Report 78-144, p. 31, April 1978).

[31] G.A. Hufford , "A Guide to the Use of the ITS Irregular Terrain Model in the Area prediction Mode, NTIA report 82-100, p.12, Apr. 1982, *quoted in* Network Affiliates Comments at 45.

[32] H&E Reply Statement at 1.

[33] Hufford, *supra*, at 12.

As every television viewer knows, buildings, trees, and other types of land clutter can interfere with a viewer's receipt of television transmissions. Accordingly, continued failure to account for the effects of land clutter in the ILLR model is simply wrong, and ensures that multitudes of consumers will be consigned to inadequate DTV signal reception.

Downlead Line Losses. The broadcasters attack the Commission's planning factors for downlead line losses as being too "conservative. [34] On the contrary, H&E has discovered a number of deficiencies in the Commission's downlead line loss factors. They lead to the conclusion that, if anything, the factors are inadequate. For example, the Network Affiliates erroneously infer, based upon review of one product from a single manufacturer, that Type RG-6 coaxial cable is subject to particular defined levels of loss lower than the Commission's planning factors.[35] H&E reports that in fact, this is not the case: as there are reports of material variation among the different RG-6 products made by various manufacturers, suggesting that the loss levels can in fact be higher than the planning factors.[36] Moreover, it is not necessarily realistic to assume that most consumers will even use RG-6 cable. Budget-conscious consumers will likely favor a less expensive alternative is available that is subject to even greater losses.[37] Finally, a number of other sources of loss, including "balun loss, "splitter loss and losses due to "impedance mismatch, are not accounted for at all.[38] It follows that the Commission's planning factor values for downlead line losses, which account only for

---

[34] Network Affiliates' Comments at 17.

[35] See Network Affiliates' Comments at 17.

[36] See H&E Reply Statement at 2.

[37] *Id.*

[38] *See id.* at 2-3.

cable losses, are inadequate and should be increased. Certainly, H&E's findings demonstrate that there is no basis for reducing downlead line loss factors, as the broadcasters suggest.

Use of Separate VHF and UHF Antennas. In determining the relevant figures for ascertaining the gain of typical consumer antennas, the broadcasters suggest the use of separate VHF and UHF antennas. Although, from a purely technical standpoint, the use of separate antennas for each band can result in improved receiving system performance, H&E reports that the use of separate antennas is atypical and unrealistic. The evidence is that consumers prefer combination antennas.[39] Not only do manufacturers appear to offer more combination antennas than VHF-only or UHF-only (doubtless a reflection of consumer preferences), but the added cost and technical complexities associated with separate antennas also make such a choice an unlikely one for consumers. Moreover, most, if not all, modern television receivers (including many of the most popular DTV receivers) lack the ability to switch between separate VHF and UHF antennas. This necessitates the installation of some external means of switching between the two antennas or combining in order to use separate antennas. This additional equipment adds to the cost and complexity of the receiving installation, and may be beyond the technical capability of some consumers.[40]

III. THE BROADCASTERS' GRATUITOUS ATTACKS ON THE INTEGRITY OF THE DBS INDUSTRY, AND ECHOSTAR IN PARTICULAR, ARE IRRELEVANT TO THIS INQUIRY

As noted above, this inquiry is about whether to make changes to the digital strength standards and testing procedures, and whether to introduce a predictive model, taking into account the statutory criteria spelled out in Section 339(c)(1) of the Communications Act.

---

[39] *See id.* at 3-4.

[40] *See id.* at 4.

Accordingly, the Commission should focus on the statutorily mandated inquiry rather than extraneous factors such as the integrity of DBS industry. The broadcasters' gratuitous attacks in this regard are completely irrelevant to the inquiry at hand.

One of these extraneous points needs to be addressed, however. The NAB refers to certain comments by EchoStar's chairman and to comments made during the proposed merger of EchoStar and DTV regarding the relatively small number of local-into-local markets that can be served with high-definition ("HD) local stations and compares them to the 155 local markets in which EchoStar currently provides local-into-local service.[41] The NAB cites this as a reason to be skeptical about EchoStar's claims about how "difficult (or uneconomical) it would be to offer digital local-into-local in a large number of markets. [42] In addition to all the other flaws of the NAB's argument, this evidences a complete failure to understand the substantial differences between the carriage of local stations in standard definition ("SD), which is what EchoStar currently does with respect to local analog stations, and carriage in HD (which was what Mr. Ergen was talking about in the passage quoted). The economics of providing HD locals is very different from the economics of providing analog locals in SD, in view of the vastly greater bandwidth required to retransmit HD signals. Thus, the fact that EchoStar today offers SD locals service in 155 markets proves nothing whatsoever about the economics of offering HD locals.

In fact, contrary to the NAB's dark intimations, EchoStar has been striving to increase the availability of over-the-air HD broadcasting to consumers. EchoStar's receivers have built-in tuners designed to receive over-the-air broadcast signals and to integrate them with its satellite television service. In fact, H&E reports that the performance of EchoStar's built-in over-the-air tuner compares favorably with the performance of the digital receivers available

[41] NAB Comments at 12 n.14.

[42] *Id.*

today.[43] EchoStar's set-top boxes are also programmed to recognize when a digital signal is being received over the air and to include the program information about these channels in EchoStar's electronic program guide.

IV. CONCLUSION

EchoStar urges the Commission to take the above reply comments and the H&E Reply Statement into account in formulating its report and recommendations to Congress.

Respectfully submitted,

/s/

Pantelis Michalopoulos
Rhonda M. Bolton
Chung Hsiang Mah
STEPTOE & JOHNSON LLP
1330 Connecticut Avenue, NW
Washington, D.C. 20036
(202) 429-3000

Counsel for EchoStar Satellite L.L.C.

David K. Moskowitz
Executive Vice President and General Counsel
ECHOSTAR SATELLITE L.L.C.
9601 South Meridian Boulevard
Englewood, CO 80112
(303) 723-1000

Karen Watson
Ross Lieberman
ECHOSTAR SATELLITE L.L.C.
1233 20th Street, N.W.
Washington, D.C. 20036-2396

July 5, 2005

[43] H&E Reply Statement at 7.

ATTACHMENT A

Reply Statement of Hammett & Edison, Inc.

Consulting Engineers

Statement of Hammett & Edison, Inc., Consulting Engineers

The firm of Hammett & Edison, Inc., Consulting Engineers, has been retained by EchoStar Satellite L.L.C. to prepare an engineering statement in support of its Reply Comments to the FCC's Notice of Inquiry in ET Docket No. 05-182, "Technical Standards for Satellite-Delivered Network Signals."[1]

Background

In its Notice of Inquiry in ET Docket No. 05-182 ("NOI"), the Commission seeks, among other things, information and comment on current regulations that identify households that are unserved by local analog broadcast television stations in order to determine if the regulations may be accurately applied to local digital broadcast stations for the same purpose. Hammett & Edison, Inc. prepared an engineering statement and associated figures, dated June 17, 2005, in support of the initial comments of EchoStar Satellite L.L.C. to that NOI. This statement considers some of the comments filed by others.

Clutter is Not Included in the Longley-Rice Model

The Joint Network Affiliates have contended that the Longley-Rice propagation model upon which ILLR is based already incorporates relevant clutter data.[2] [3] However, their position is inconsistent with the citation that they offer as justification. At page 45, the Joint Networks quote from Hufford,[4] "It should then be noted that these data were obtained from measurements made with fairly clear foregrounds ... [i]n general, ground cover was sparse...." (emphasis added) Fairly clear foregrounds and sparse ground cover are indicative of careful site selection, which is meant to minimize the effects of clutter.

As EchoStar has repeatedly pointed out, the Longley-Rice model does not incorporate land use and land cover (clutter) in any systematic or relevant way. A comparison between measured and predicted (using Longley-Rice) signal strengths was conducted and reported by Anita Longley, *et al.* of the Institute for Telecommunications Sciences.[5] As the report's principal author, Ms. Longley notes that there are many cases when the results of the predictive model do not agree with the field measurements. At page 5, she writes, "Some of the differences between predicted and measured median values may be caused by terrain clutter, such as buildings and trees, which has not yet been

---

1 FCC 05-94, adopted April 29, 2005.

2 Joint Comments of the ABC, CBS, and NBC Television Affiliate Associations to ET Docket No. 05-182, pp. viii, 45, June 17, 2005.

3 Joint Comments of the ABC, CBS, Fox, and NBC Television Network Affiliate Associations to ET Docket No. 00-11, p. vii, February 22, 2000.

4 G.A. Hufford, "A Guide to the Use of the ITS Irregular Terrain Model in the Area prediction Mode," NTIA Report 82-100, p. 12, Apr. 1982.

5 A. G. Longley, "Measured and Predicted Long-Term Distributions of Tropospheric Transmission Loss," OT/TRER Report No. 16, July 1971.

included in the prediction models." (emphasis added) In 1978, she wrote, "The [Longley-Rice] propagation model calculates transmission loss, with allowances for radio frequency, terrain irregularity, path length, and antenna elevation. Most of the data previously considered [in developing the model] were from open areas, towns and small cities. To this model, we can now add an allowance for the additional attenuation due to urban clutter...."[6] (emphasis added) She then describes a method for incorporating the effects of clutter, but this method is not incorporated into version 1.2.2 of the ITS Irregular Terrain Model, which underpins ILLR.

While we agree that some of the data sets used in the development of the Longley-Rice model unavoidably contained clutter, most did not, and the type or degree of such clutter, when present, was not systematically collected or included in the model. Until better data are available, there is no justification for eliminating the ILLR clutter factors.

Downlead Line Losses Not Conservative

Based upon a review of one product from a single manufacturer (Channelmaster Pro Install), the Joint Networks infer that fifty feet of Type RG-6 coaxial cables have losses of less than 1 dB at low-band VHF channels, less than 2 dB at high-band VHF channels and less than 3 dB at UHF channels 14–51. The maximum loss at UHF is given as 2.76 dB. In fact, however, there is some variation in the loss of RG-6 cable. For example, Belden Cable[7] lists a loss of 3.3 dB at Channel 51 for its Model 1152A Type RG-6 cable. A 1979 study conducted by the NTIA[8] found a range of 2.7–4.3 dB for various models of dry Type RG-6 cable at Channel 51. In addition, not all consumers will use Type RG-6 cable. Type RG-59 cable is less expensive than Type RG-6 cable, and may be selected by price-conscious consumers; NTIA reports that this cable has losses of 3.5–6 dB. Aging of the downlead cable or water in it, regardless of type, would further increase its loss.

In addition to the attenuation (loss) of the cable itself, there are generally other losses in the downlead system between the antenna and the television set. Most television antennas are designed with an operating impedance of about 300 ohms, while Type RG-6 cables and television receivers are designed with an operating impedance of 75 ohms. The conversion between these two impedance values is typically accomplished at the antenna using a device called a "balun."[9] Baluns have loss associated

---

6 A. G. Longley, "Radio Propagation in Urban Areas," OT Report 78-144, p. 31, April 1978.

7 http://bwccat.belden.com/ecat/pdf/1152A.pdf

8 R.G. FitzGerrel, *et al.*, "Television Receiving Antenna System Component Measurements," NTIA Report No. 79-22, pp. 32–37, June 1979.

9 An abbreviation for BALanced to UNbalanced transformer.

with them, averaging about 0.6 dB at low-band VHF channels, 1.5 dB at high-band VHF channels, and 2.5 dB at UHF channels.[10]

Many households have several television receivers,[11] which may share a common antenna. This sharing is accomplished by the use of a power divider (so-called "splitter"), which allows a single downlead cable to be split into two or more outlets. The minimum loss associated with such splitters is calculated as

$$L_{db} = 10\log\frac{1}{N}$$

where N is the number of outlets in the splitter. Thus, the two-outlet splitter typically found in many homes, therefore, has a loss of at least 3 dB. Finally, the impedance matches among the antenna, balun, downlead, splitter, and receiver are undoubtedly imperfect. Typical additional losses due to the impedance mismatch have been reported[12] [13] as approximately 2 dB at VHF low-band channels, and 2.5 dB at VHF high-band and UHF channels.

Thus, additional losses associated with a typical consumer downlead system, including balun, splitter, and impedance mismatch total about 5.6 dB at low-band VHF channels, 7 dB at high-band VHF channels, and 8 dB at UHF channels. The corresponding planning factor values of 1, 2, and 4 dB account only for cable losses. Thus, there is therefore considerable justification for increasing the losses assumed to be associated with the downlead system, and there is certainly no justification for reducing them.

Assumed Use of Separate VHF and UHF Antennas Not Appropriate

Both the Joint Networks[14] and NAB[15] suggest that the relevant figures for determining the gain of typical consumer receiving antennas should be taken from separate VHF and UHF antennas. We agree that the use of separate antennas for each band can result in improved receiving system performance, since each antenna can be optimized for its particular range of channels. However, the use of separate antennas is atypical in our experience, and the literature suggests strongly that combination antennas are commonly preferred by consumers.[16] Indeed, most of the product lines referred to by the Joint Networks and NAB show a preponderance of "all channel" antennas. For example, the Winegard

---

10 FitzGerrel, *op. cit.*, p. 25.

11 GAO Report GAO-03-7, "Telecommunications: Additional Federal Efforts Could Help Advance Digital Television Transition," released December 2, 2002.

12 Oded Bendov, *et al.*, "DTV Coverage and Service Prediction, Measurement and Performance Indices," Proc. IEEE Broadcast Technology Symposium, 2001.

13 FitzGerrel, *op. cit.*, pp. 29–30.

14 Joint Comments, *op. cit.*, pp. 18–23.

15 Comments of the National Association of Broadcasters to ET Docket 05-182, pp. 21–22, June 17, 2005.

16 *E.g.*, FitzGerrel, *op. cit.*

antenna cut-sheets submitted by NAB list 6 VHF-only antennas, 11 UHF-only antennas, and 16 combination "all channel" antennas, the latter representing nearly half of the total. One would expect that antenna manufacturers would devote the largest portion of their product lines to popular antennas designs, as opposed to specialty antennas. VHF-only and UHF-only antennas are used professionally, for example by cable television headends that seek maximum performance in the reception of a single station. It seems clear, on the other hand, that combination "all channel" antennas are the ones most commonly purchased and used by consumers.

There are also economic penalties and technical difficulties associated with the use of separate VHF and UHF antennas. Obviously, the cost of purchasing two antennas and two downlead cables will generally be greater than purchasing a single all-channel antenna and single downlead cable. Most, if not all, modern television receivers (including all of the DTV receivers we are familiar with) do not have the capability of switching between separate VHF and UHF antennas. So, some external means of switching between the two antennas or combining them together will have to be installed, if separate antennas are to be used. This additional equipment adds to the cost and complexity of the receiving installation, as well as additional downlead system losses, and may be beyond the technical capability of some consumers.

"Fifth-Generation" And Later Receivers Still Have Problems

We agree with NAB that the latest receivers, so-called "fifth generation" designs, do appear to have superior abilities to receive ATSC signals in the presence of certain types of multipath. However, the white noise enhancement penalty associated with the operation of the equalizer in the DTV receiver still remains and must be considered. As previously discussed,[17] the presence of multipath at a receiving site effectively reduces the available strength of the DTV signal at that site because the equalizer in the receiver generates noise in proportion to the degree of multipath. For example, if there is 3 dB of white noise enhancement, then a receiver that had a 15.2 dB noise threshold under ideal conditions (*i.e.*, no multipath) will have a 18.2 dB noise threshold under the multipath condition. This 3 dB increase is equivalent to a halving of the transmitter power of the DTV station. NAB presents data,[18] which shows that fifth generation receiver performance under some static multipath conditions requires 3–4 dB of additional signal to overcome the white noise penalty. Since white noise enhancement can be substantial at sites having severe multipath, it is important that this parameter be measured and subtracted from the nominal measured field strength in any field test.

---

17 Comments of EchoStar, to ET Docket 05-182, Engineering Statement, p. 8.

18 NAB comments, *op. cit.*, Table 12 at p. 41.

Equally important difficulties associated with producing a usable DTV picture under dynamic (as opposed to static) multipath conditions remain largely unaddressed in the fifth generation designs, which may account for the continuing failure to receive about 10% of signals under empirical conditions.[19] Further, improvements in the performance of the fifth generation demodulators do nothing to improve the performance of other components in the DTV receiver. Specifically, the performance of the tuners in consumer DTV receivers has been criticized as limiting DTV reception in the presence of otherwise adequate signal levels.[20] While these DTV tuner problems are largely associated with the presence of strong interfering signals, there may be impacts at many locations on consumer reception of network signals.

Consumers also have no knowledge of what "generation" DTV receiver they are purchasing. The "generational" association is largely a consumer electronics industry distinction, which has not been communicated to the consumer. Indeed, despite our inspection of its internal components, we were unable to determine the "generation" of one of the receivers that we recently tested, and so tried to obtain that information from the manufacturer. The manufacturer flatly refused, stating that, "[it] does not supply any information about the design or components of its consumer retail products." Unless the consumer is given information concerning the performance of his DTV receiver, as CEA is apparently attempting to do in the case of antennas with its "antenna labeling program,"[21] the advantages of the latest technological developments may be lost on the consumer, who can be expected to seek the product having the lowest cost.

FCC Planning Factors Were Intended Primarily For Channel Allotments

The planning factors for DTV used by the FCC were adopted years before any consumer DTV receivers were available. They were adopted, in part, in order that a Table of DTV Channel Allotments might be developed, which assigned a second channel to each analog TV station in the U.S. Some of the assumptions underlying these factors would be inappropriate in this context, as marketplace experience has been gained. For example, the FCC assumed different receiving antenna patterns for NTSC and DTV.[22] The counter-intuitive assumption resulting from that decision was that consumers would install better-performing antennas for DTV use. In fact, a more reasonable assumption for the purpose of assessing consumer reception is that they will not.

---

19 Tim Laud, *et al.*, "Performance of 5th Generation 8-VSB Receivers," IEEE Trans. Consumer Electronics, Vol. 50, No. 4, November 2004.

20 Charles W. Rhodes, "Interference Between Television Signals Due to Intermodulation in Receiver Front-ends," Proc. IEEE Broadcast Technology Symposium, 2004.

21 Joint Comments, p. 21.

22 See H&E Petition for Reconsideration in MM Docket No. 87-268, filed June 13, 1997.

The specified 28 dBu minimum field strength required for DTV reception at VHF low-band has also been criticized as being sorely inadequate,[23] due in large part to an inadequate consideration of man-made noise at those channels. Additionally, the planning factors assumed that interference from DTV stations operating on other than co- and adjacent-channels would not exist. This assumption was based upon the performance of a dual-conversion prototype DTV receiver. However, most if not all consumer DTV receivers are single-conversion, meaning that they are far more susceptible to interference from some so-called "taboo channels." Now that several generations of consumer DTV receivers are available, it would be appropriate for the Commission to consider using more empirically tested planning factors in this proceeding, since they more accurately reflect the consumer's ability to actually receive a DTV picture.

Time Variability of DTV Signal

None of the other commenters in this proceeding appears to mention that a correction is needed to account for the variation over time of the DTV signal. The FCC's criterion for DTV coverage is a specified threshold field strength with 50% confidence, 90% of the time, that is, a situational variability factor of 50% and a time variability factor of 90%, commonly written as F(50,90). As previously mentioned, a single set of cluster measurements cannot adequately characterize the time variability to provide reasonable assurance that the DTV signal will be available 90% of the time. So, a 90% time (or greater) reliability factor should be applied to the assumed median value obtained during the cluster measurements to adjust the assumed "typical" measured field strength to a 90% time value.

Additional Data on Variability Among Consumer DTV Receivers.

Tests on an additional DTV receiver, Dish Model DP942, have been completed since our June 17, 2005, statement was prepared. For completeness, data on all six DTV receivers (five consumer and one professional model) are presented here for comparison with the FCC's planning factors, as follows:

1. LG LST-4200A
2. Samsung SIR-T451
3. Motorola HDT101
4. Dish DP942
5. RCA DTC100
6. Zenith DTVDEMOD-S

---

[23] Victor Tawil and Charles Einolf, Jr., "Impact of Impulse Noise on DTV Reception at Low VHF," Proc. IEEE Broadcast Technology Symposium, 2004.

Receivers 1, 2, 3, and 4 were obtained from retail vendors in May 2005. Receiver 5 is an older model, purchased in 2000. All of the consumer receivers are set-top boxes in the under $300 price range.[24] Receiver 6 is a professional ATSC demodulator, which provides detailed information concerning equalizer performance, error rate, and other parameters.

The receivers were set up at a location (Alameda, California) having favorable path characteristics for DTV reception; that is, relatively constant signal levels, and multipath components having minimal amplitude and short delay. The receivers were connected to a common antenna and attenuation was added in 1 dB steps until visible failure of DTV reception occurred. The measurements show the differences in sensitivity of the receivers under favorable field conditions. The estimated margin of error for these measurements was ±1.5 dB.

	Measured Sensitivity by Channel, dBm						
Receiver	D12	D23	D29	D41	D43	D47	D49
1	-81.9	-82.6	-84.1	-82.8	-80.4	-81.1	-81.8
2	-80.9	-80.6	-83.1	-80.8	-81.4	-81.1	-82.8
3	-78.9	-83.6	-83.1	-83.8	-83.4	-82.1	-82.8
4	-81.7	-82.9	-84.1	-82.9	-82.8	-81.5	-81.9
5	-75.9	-78.6	-82.1	-77.8	-77.4	-78.1	-78.8
6	-75.9	-78.6	-79.1	-77.8	-79.4	-79.1	-79.8
Variation in Sensitivity, RX1–5	5.8 dB	5.0 dB	5.0 dB	6.0 dB	6.0 dB	4.0 dB	4.0 dB
Average Sensitivity, dBm, RX 1–5	-79.9	-81.7	-83.3	-81.6	-81.1	-80.8	-81.6
FCC PF, dBm	-81.2	-84.2	-84.2	-84.2	-84.2	-84.2	-84.2

The above results show that consumer receivers can differ in sensitivity by 2–6 dB under favorable field conditions.

After compensating for the white noise enhancement of the equalizer (typically 0.2 dB), which was taken from Receiver 5 and assumed to apply to all of the other receivers, the sensitivities can also be compared with the FCC planning factor ("PF") values of -81.2 dBm at VHF and -84.2 dBm at UHF. Depending upon the channel involved, some receivers were up to 6.8 dB less sensitive than the planning factors specify. Considering all channels, the typical receiver was 2.4 dB less sensitive than the FCC planning factors.

Bear in mind that this sensitivity field test was intended to minimize, but not eliminate, the generational differences between the 8-VSB demodulators within the various receivers. During testing, it was clear that the oldest receiver (#5) had difficulties with adjacent-channel interference. Specifically, the DTV Channel D43 had a collocated NTSC facility on Channel N44, and DTV Channel

[24] The Dish unit includes a satellite receiver and digital video recorder, and is provided to subscribers free of charge when ordered with certain service tiers.

D49 had a collocated NTSC facility on Channel N48, which also affected reception on Channel D47. All of the receivers tested showed improvement over this "first-generation" model.

Robert D. Weller
Robert D. Weller, P.E.

July 5, 2005